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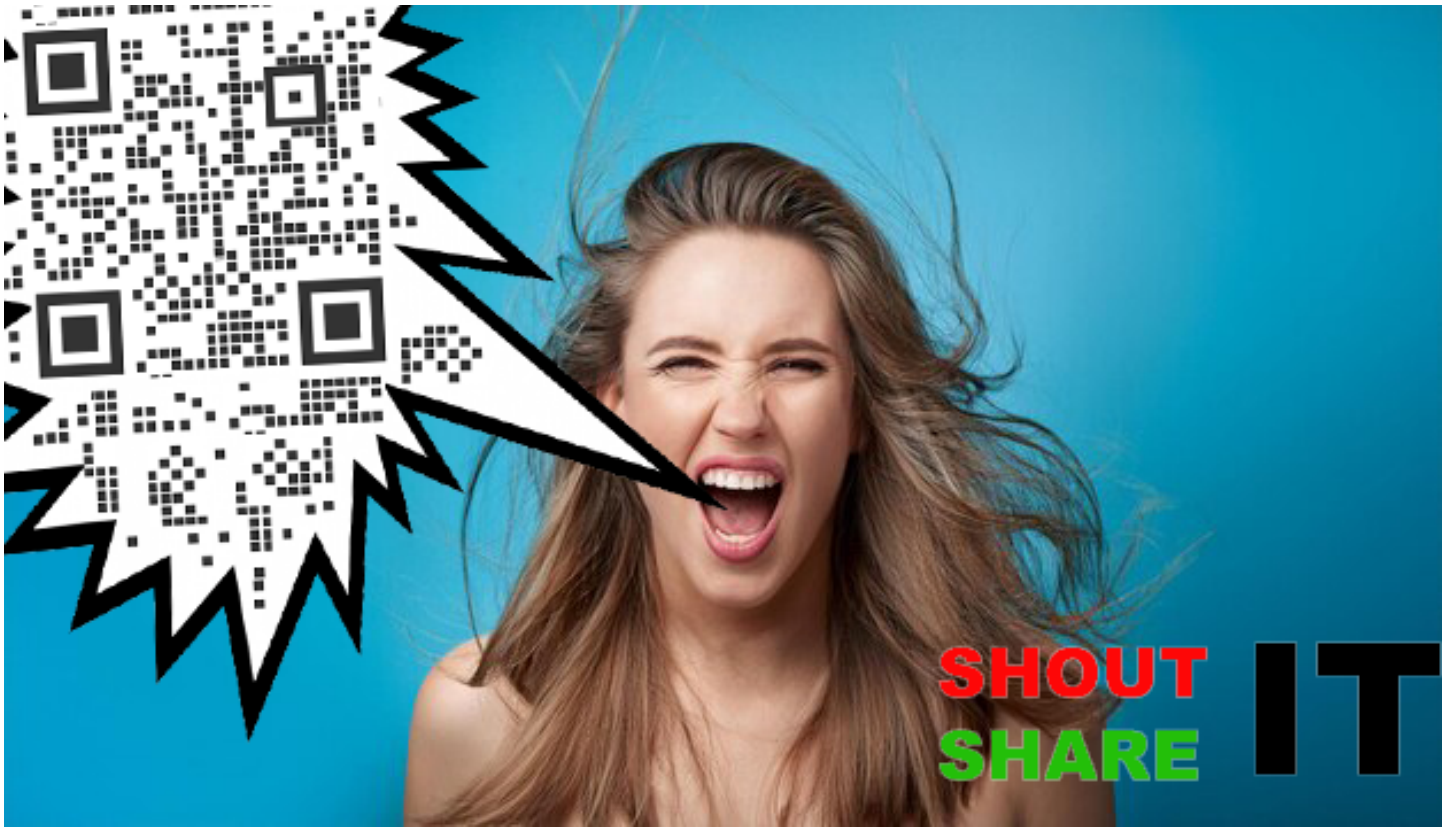
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FOOD OF AMERICAN PHALAROPES, AVOCETS, AND STILTS [1]

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CONTENTS

	Page		Page
General description	1	Wilson phalarope	8
Red phalarope	2	Avocet	12
Northern phalarope	4	Black-necked stilt	16

GENERAL DESCRIPTION

The five species of shorebirds of which the economic status is discussed in the following pages are forms that have become specialized for life under certain conditions, and on the whole are not of common occurrence, save in the particular marshes or on the large bodies of fresh or salt water which form their haunts. They are thus unknown to many persons familiar with bird life in more thickly populated districts. All are at present fully protected by law and because of their commendable food habits there can be no question of the inadvisability of any attempt to establish an open season for any of them. The phalaropes—small, close-feathered, snipelike birds that swim on the water like tiny ducks—are too slight in body to be killed for their flesh; avocets and stilts, though larger, do not produce meat of a quality suitable for table use. All these birds are tame and fearless, so that there is little sport in hunting them. In addition to possessing habits of the greatest interest, it is found that the phalaropes, avocets, and stilts have a certain economic importance.

The family of phalaropes includes three species, all of which occur within the United States. The northern and red phalaropes are practically world-wide in their distribution, but the Wilson phalarope is restricted to the Western Hemisphere. The two cosmopolitan species are boreal in occurrence during the breeding season and do not often come in close contact with man, except in migration. The northern phalarope, a species that in point of size ranks among our

[1] This bulletin presents a detailed study of the food and feeding habits of the phalaropes, avocets, and stilts that occur in the United States, showing the economic status of the five species, for the information of conservationists, sportsmen, and others interested in our shorebirds.

[2] This report was prepared while the author was on the staff of the Biological Survey from which he resigned on November 19, 1924.

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smallest shorebirds, is of importance economically in that it destroys many of the larval forms of mosquitoes, thus aiding in keeping these pests in check. The red phalarope within our limits is most abundant on the oceans off our shores and so does not often come in direct contact with injurious insects. The Wilson phalarope is the one most frequently found near cultivated districts and is perhaps better known than the other two. It does considerable good in destroying mosquitoes and also consumes many of the larvæ of horseflies. Adult horseflies are often the greatest of pests in districts adjoining marshes. No injurious traits are recorded against any of the three phalaropes; their food, save as indicated, consists of insects, crustaceans, or other animals which are of neutral economic significance.

The stilt may be commended for its evident taste for billbugs and other weevils, as well as crawfish and giant water bugs, all of which are destructive. Though it may eat a few small fishes, the forms taken are not of value for human food. The avocet shares with the stilt a taste for weevils, including forms that are injurious. It takes much more vegetable food than any of the other birds treated in this bulletin. Like the phalaropes, the stilt and the avocet have no marked injurious traits.

Because of their specialized habits, the Wilson phalarope, the avocet, and the stilt have suffered a considerable reduction in numbers from man's encroachment upon their haunts. The draining of swamps and marshes has decreased the areas available to them as breeding and feeding grounds, and many have been destroyed by gunners. With the well-merited protection accorded them at present, these birds may be expected to hold their own or even to increase wherever they meet especially favorable conditions; it is even possible that they may repopulate some of the areas from which they have been absent for many years.

RED PHALAROPE

Phalaropus fulicarius

The red phalarope, circumpolar in distribution during the summer season, in the Western Hemisphere breeds from northern Alaska and northern Ellesmere Land south to the mouth of the Yukon and southern Greenland. The winter range can not be traced with any degree of certainty, but at this season the birds are known to pass south well over the southern half of the globe. Except during the breeding season, the red phalarope is maritime in range, though stragglers are taken casually in the interior. The writer has examined in the flesh one collected in eastern Kansas, and others are recorded from Colorado, Illinois, and Maryland.

During migration, flocks of red phalaropes occasionally come to brackish lagoons or fresh-water ponds near the seashore, or run along sand beaches in company with other shorebirds. More usual haunts are broad salt-water bays or the open ocean, so that the present species is less commonly observed than the other phalaropes. Ocean expanses have no terrors for the red phalarope, and at times flocks are found several hundred miles from shore. In the breeding plumage the red phalarope is handsomely marked with dull cinnamon-brown beneath, whereas in winter the plumage of the lower parts is pure white. In the latter condition care must be taken not to confuse it with the northern phalarope.

FOOD

The material at hand representing the food of the red phalarope, 36 stomachs in all, is in the main from the Pribilof Islands, Alaska, though some comes from New York and Maine. The stomachs available were collected from May to November, with August best represented. The red phalarope is active in feeding, seizing living prey on the surface of the water, or searching for food along the beaches. The food may be considered to be entirely animal, as a seed or two encountered in two stomachs make a mere trace of vegetable matter.

Crustacea.—Crustaceans, the group best represented among the animals eaten, constitute 33.5 per cent of the total food. Among these, amphipods (8.9 per cent) were identified in 14 stomachs. In one case the remains were those of *Carinogammarus mucronatus* and in another *Hyallela knickerbockeri*. The peculiar seedlike winter eggs of certain water-fleas (Daphniidæ) were encountered three times. Miscellaneous unidentified crustaceans composed the remainder of this part of the food. It is probable that the bulk of these fragmentary individuals consisted of amphipods also.

Coleoptera.—Beetles amount to 27.3 per cent and are well represented in birds taken in Alaska. Ground beetles belonging to a genus that is very common in the Pribilof Islands (*Pterostichus*), were taken six times. A representative of another genus (*Amara*) was encountered once. Rove beetles (in one instance *Olophrum fuscum* and in another *Hadrotes*) were found four times in all. A peculiar beetle (*Eurystethus californicus*) of small size, and for many years known in museums from only one or two specimens, was found in two instances. Weevils were encountered twice, crawling water-beetles (Haliplidæ) once, and the larval stage of another beetle once.

Diptera.—Following beetles, the flies (22.7 per cent), are the order of insects eaten most frequently. A group of dung flies (including *Scatophaga crinita, S. dasythrix*, and allied species) abundant in the North was best represented, as it was encountered in 14 stomachs. Gnats (Chironomidæ) were identified twice and their larvæ once. A larval soldier fly (stratiomyid) was eaten by one bird and a crane fly (tipulid) by another. Larvæ and pupæ of dipterans that were not identified were found in eight instances.

Pisces.—Tiny fishes had been eaten by 15 of the birds examined. In one case the fragments remaining were indeterminate, but in the others all fish remains were sculpins (Cottidæ), species of no economic value. These totaled 6.8 per cent, and were eaten in August and September.

Miscellaneous.—The remaining part of the food (9.7 per cent) was composed of miscellaneous animals picked up apparently at random. Ants, water-boatmen (Corixidæ), and spiders, were each taken by one bird. One phalarope had eaten a very small mussel (*Mytilus edulis*) and a second mollusk was found in another. The former, although used as human food, is so small an item in the diet of this bird as to have no importance. A tiny ball of hair completed the miscellaneous animal matter.

SUMMARY

The red phalarope exhibits no marked economic tendencies, as its food is composed of forms that are more or less neutral. The ground beetles taken are in all probability scavengers and are not active in

the control of injurious insects. The flies are not known to be of economic importance. and the crustaceans have value merely as food for other animals. From this review it may be seen that the red phalarope is entirely harmless and should be protected when it chances to occur within our boundaries.

NORTHERN PHALAROPE

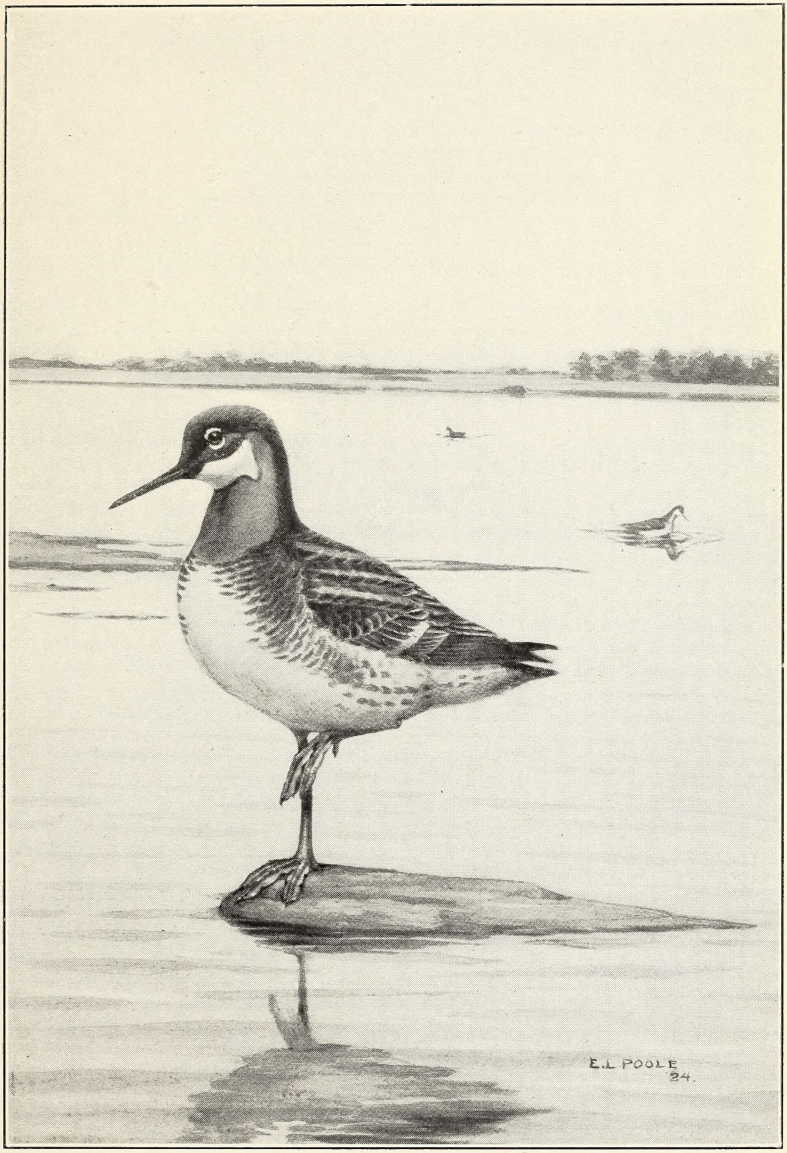
Lobipes lobatus

Like the preceding species, the northern phalarope (Pl. I) nests in the Northern Hemisphere in both Old and New Worlds. In North America the breeding range extends from the Near Islands in the Aleutian Chain across to eastern Greenland, and from Melville Island south to the delta of the Yukon and to Rupert House, Ontario. The place and extent of the winter home of the northern phalarope at present is uncertain, though it is supposed that at this season the birds remain at sea in the Southern Hemisphere. They have been noted casually on the coasts of Patagonia and Peru, but on the whole are unknown after they leave our shores. In migration they occur casually throughout our country save in the States bordering the Gulf of Mexico, but are more abundant near the eastern and western coasts, and great numbers pass through the interior by way of Great Salt Lake, Utah.

In migration these phalaropes often gather in great flocks where food is abundant. On reaching their breeding grounds in the north, they pair off to nest in marshy spots or near small fresh-water lakes in the tundras. On Kiska Island in the Aleutians in June, the writer found them breeding about innumerable shallow lakes in the small valleys that lead back from the beaches of the deeper bays. The eggs, four in number, were placed in shallow nests concealed in grass 8 or 10 inches high. Adults were greatly excited by intruders and flew swiftly about calling sharply. Many fed in the surf, often riding the waves until these were about to break, when to avoid being dashed on the sand they rose lightly in the air and flew out a few feet to a point of safety. Both sexes go through curious gyrations on the water surface, whirling rapidly about and nodding the head.

Domestic cares after the eggs have been deposited devolve entirely upon the willing males, and many of the females depart southward at once, to be followed by males and young when the latter are able to fly. The northward migration in Utah does not end until the middle of June, and by the first week in July females begin to return from the north. The southward movement continues from July through the month of October.

Northern phalaropes swim as readily as ducks and secure much of their food from the water. Little flocks alight on the surface, and the individuals, separating 12 or 15 feet from one another, begin to quarter back and forth in search of food. They swim rapidly with quickly nodding heads, jabbing constantly at any morsels that appear within reach. When thus occupied the course pursued by individual birds is most erratic, as they turn constantly from side to side or whirl quickly about as food appears within reach behind them or at one side. Occasionally they run about on mud bars or beaches like other sandpipers, or when filled to repletion gather in the shallows, where they bathe or stand about resting, caring for their feathers, or sleeping.



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NORTHERN PHALAROPE

Lobipes lobatus

One hundred and fifty-five stomachs examined in determining the economic status of the northern phalarope are representative of the food of this bird, save when it is absent from the United States in winter. The material available is distributed rather evenly throughout the months from May to October, inclusive. That representing the food during the breeding season comes from Alaska, but the remainder was taken through the Northern States and California. Animal food forms 97.2 per cent, and seeds and some miscellaneous vegetable matter make up the remainder (2.8 per cent).

ANIMAL FOOD

Crustacea.—In the series of stomachs examined crustaceans come to 9.3 per cent, and are represented in every month. Eighteen birds taken in September had eaten these animals to the extent of one-fourth of their food, but at other seasons the number taken is less. When phalaropes are feeding at sea, no doubt crustaceans are eaten in much greater quantity than here indicated. Amphipods, fragments of which were found in 10 stomachs, form an easily obtained food, especially in northern waters. The curious winter eggs of another group of crustaceans (Daphniidæ) were found in two individuals. These eggs resemble a small seed pod with two black spots on either side. They must be present in abundance in some Alaskan localities, as they are eaten frequently by small shorebirds.

Brine shrimps (*Artemia fertilis*) were identified in eight birds taken on Great Salt Lake, Utah. These curious animals, less than an inch in length, abound in the concentrated brine of lakes in the Great Basin, being one of the few creatures that have become adapted to water so strongly saline. In Great Salt Lake these shrimps swarm in the shallow bays. The bodies of brine shrimps are soft and friable with no hard parts to resist digestion. Their detection in stomach examination is difficult, as the diffuse eye-spots or eggs in the case of breeding females, are the only characters that may be recognized. In the field it was observed that northern phalaropes were feeding extensively upon brine shrimps, and stomachs of those killed bear out this observation. It is certain that these crustaceans are an attractive food and that large numbers are eaten. Other crustaceans than those previously mentioned, in two instances isopods (Cymothoidea), were found in four other stomachs.

Hemiptera.—True bugs are an important source of food, amounting to 31.8 per cent of the whole. The bulk of them are the widely distributed water-boatmen (Corixidæ), eaten by 42 birds. Back-swimmers (Notonectidæ) were eaten by 5 birds, and miscellaneous forms, mainly unidentified, by 12. The favored species in this order of insects are those of aquatic habit.

Coleoptera.—Beetles were found abundantly in the examination of these stomachs and totaled 16.5 per cent of the food. Species that live in the water or are found on muddy shores are well represented. Ground beetles (Carabidæ) were found 12 times. Crawling water-beetles (Haliplidæ), small species occurring in submerged vegetation, were taken 10 times. Four species were definitely identified. The predacious diving beetles (Dytiscidæ) seem to be especially favored, adult forms being found in 20 stomachs and larval in 14. Water-scavenger beetles (Hydrophilidæ) were found in 19 stomachs and their larvæ in 6. Unidentified aquatic beetles occurred 14 times.

Weevils also were well represented, occurring in 24 stomachs. Miscellaneous beetles of other groups were represented by casual individuals in a number of stomachs. The identified material is listed in Table 1.

Diptera.—Flies made up the greatest part of the food of the northern phalarope—32.8 per cent of the whole. The most important element in this division is the larvæ of mosquitoes, which alone amount to 6.3 per cent of the entire food. Remains of these larvæ, identified usually by their breathing tubes, were found in 29 stomachs, all but one collected in May and June. The strange, long-legged crane flies were taken twice, while their larvæ, aquatic in habit, were found 13 times. Gnats (Chironomidæ) were abundantly represented. Larvæ were identified in 22 stomachs, pupæ in 17, and adults in 16. The immature stages are found in water, in which they swarm in many localities.

In the salt lakes of the Great Basin region larvæ, pupæ, and adults of the alkali flies (Ephydridæ) furnish an abundant food. On Great Salt Lake northern phalaropes divide their attention between brine shrimps and the young stages of the alkali flies. Larvæ and pupæ of the latter abound in the shallows and form a rich supply of food. Adult individuals of *Ephydra*, found 14 times, are secured as they rest on the surface film of the water or congregate on muddy shores. Larvæ and pupæ were identified 24 times. So abundant are these alkali flies that cast skins of the pupæ drift ashore to form brown windrows, which often extend for miles along the beaches. Formerly the Indians utilized this food supply by gathering the pupæ and preserving them for winter use.

Mollusca.—Small mollusks amounted to 2.7 per cent of the food of the northern phalarope for the period under consideration. All of those identified were snails (*Physa gyrina* one and *Planorbis trivolvis* eight) or other gastropods.

Miscellaneous.—Dragonfly nymphs (amounting to 0.2 per cent of the total) were eaten by three birds. Arachnida, another minor item in the food, came to 0.1 per cent. Spiders were identified four times, water-mites (Hydrachnidæ) twice, and another mite once. Other miscellaneous animal food, a grouping including a variety of forms not found abundantly enough to merit separate tabulation, amounted to 3.8 per cent. In these the larvæ of Mayflies were encountered four times and a grasshopper once. A marine worm of an abundant genus (*Nereis*) and neuropterans were found in the stomachs of two birds each. Fragments of moths in two cases, and skins of caterpillars in two, represented the Lepidoptera; and several small species, the Hymenoptera. These latter include ants and a few parasitic forms, which, from the fact that they must have been picked up by chance, have no particular economic significance. The class of vertebrates was represented by bones of a tiny fish.

VEGETABLE FOOD

The vegetable diet of the northern phalarope was made up of seeds, and, though amounting to only 2.8 per cent of the entire food, was taken regularly. In all, vegetable matter was identified in 38 stomachs. Among the more important plants represented may be mentioned widgeon grass (*Ruppia*), eaten 10 times; sago pondweed (*Potamogeton pectinatus*), 3; bulrush (*Scirpus*), 11; and salt grass

(*Distichlis spicata*), 3 times. These seeds are in the main fairly firm and hard, and this, with the small number taken, suggests that they were swallowed in part in lieu of gravel. Gravel is a fairly common element in these stomachs but may at times be difficult to obtain.

SUMMARY

The northern phalarope is among the smallest of our shorebirds. Although better known than the preceding species its ways do not bring it directly in contact with man. The bulk of its food is composed of animal matter. A large part is of slight economic importance, as the forms taken are of no significance in relation to crops or other products save as they may perchance furnish food for other organisms. Attention must be called however to the large number of mosquito larvæ consumed by the birds in May and June. In helping to check these pests, the northern phalarope demonstrates its value, and for this reason is worthy of every consideration.

TABLE 1.—*Material identified in the food of the northern phalarope as determined from the examination of 155 stomachs, and the number of stomachs in which each item was found*

Animal Matter	
ANNULATA	
Nereis sp. (marine worms)	2
CRUSTACEA	
Unidentified	2
PHYLLOPODA	
Artemia fertilis (brine shrimps)	8
Daphniidæ (waterfleas) (winter eggs)	2
AMPHIPODA (shrimplets)	
Pontoporeia sp	1
Gammarus confervicolus	5
Gammarus sp	1
Other amphipods	3
ISOPODA (sowbugs)	
Cymothoidea	2
ODONATA (dragonflies)	
Dragonfly nymphs	3
EPHEMERIDA (Mayflies)	
Ephemeridæ (larvæ)	4
ORTHOPTERA (grasshoppers, etc.)	
Unidentified grasshopper	1
HEMIPTERA (true bugs)	
Corizus sp	1
Notonecta sp. (back-swimmers)	5
Corixidæ (water-boatmen)	42
Other heteropterans	6
Agallia sanguinolenta (leaf hopper)	1
Other homopterans	4
TRICHOPTERA (caddisflies)	
Chilostigma praeteritum	1
LEPIDOPTERA (butterflies and moths)	
Unidentified moths	2
Unidentified caterpillars	2

Animal Matter—Continued	
COLEOPTERA (beetles)	
Dyschirius sp	1
Bembidion sp	7
Pterostichus sp	1
Amara sp	1
Other Carabidæ (ground beetles)	2
Haliplus borealis	1
Haliplus ruficollis	1
Haliplus longulus	1
Haliplus sp	4
Peltodytes callosus	2
Other Haliplidæ (crawling water-beetles)	1
Laccophilus sp	1
Coelambus sp	5
Deronectes sp	3
Hydroporus sp	3
Dytiscidæ (larvæ)	14
Other Dytiscidæ (predacious diving beetles)	8
Berosus sp	18
Berosus sp. (larvæ)	2
Other Hydrophilidæ (larvæ)	4
Other Hydrophilidæ (water-scavenger beetles)	1
Sphaeridium scarabaeoides	1
Unidentified aquatic beetles	14
Cafius bistriatus	1
Other Staphylinidæ (rove beetles)	1
Heterocerus sp	3
Dolopius lateralis	2
Unidentified Elateridæ (click beetles)	1
Monoxia sp	2
Systena bitaeniata	1
Systena sp	1
Crepidodera sp	1
Other Chrysomelidæ (leaf beetles)	1
Blapstinus sp	1
Otiorhynchidæ (weevils)	1
Hyperodes sp	1
Bagous restrictus	1
Rhinoncus pyrrhopus	1
Other Curculionidæ	7
Scolytidæ (bark beetles)	3
Unidentified Rhynchophora	10
DIPTERA (flies)	
Tipulidæ (crane flies)	2
Tipulidæ (larvæ)	13
Chironomus sp	3
Orthocladius sp	2

TABLE 1.—*Material identified in the food of the northern phalarope as determined from the examination of 155 stomachs, and the number of stomachs in which each item was found*—Continued

Animal Matter—Continued	
DIPTERA (flies)—Continued	
Chironomidæ (larvæ)	22
Chironomidæ (pupæ)	17
Other Chironomidæ (gnats)	11
Aëdes (Heteronycha) spencerii (larvæ)	26
Other Culicidæ (mosquitoes) (larvæ)	3
Stratiomyiidæ (soldier flies) (larvæ)	4
Dolichopodidæ (long-footed flies)	1
Syrphidæ (flower flies) (larvæ)	8
Leria leucostoma	2
Ephydra gracilis (adults and pupæ)	5
Ephydra hians (larvæ)	1
Ephydra sp. (adults)	14
Ephydra sp. (larvæ and pupæ)	18
Other Ephydridæ (alkali flies)	1
Unidentified dipterous larvæ and pupæ	6
Other dipterans	12
HYMENOPTERA (ants, bees, and wasps)	
Syrphoctonus sp.	1
Alloxysta sp.	1
Zelotypa sp.	1
Camponotinæ	1
Unidentified ants	5
Bethylidæ	1
Crabronidæ	1
Other hymenopterans	1
ARANEIDA (spiders)	
Spiders	4
Animal Matter—Continued	
ACARINA (mites)	
Hydrachnidæ (water-mites)	2
Unidentified mite	1
MOLLUSCA (snails)	
Physa gyrina	1
Planorbis trivolvis	8
Littorina sitchana	2
Other gastropods	7
PISCES (fishes)	
Unidentified fish	1
Vegetable Matter—Seeds	
Ruppia occidentalis (widgeon grass)	10
Potamogeton pectinatus (sago pondweed)	3
Panicum sp. (switch-grass)	1
Distichlis spicata (salt grass)	3
Cyperus sp. (nut-grass)	1
Scirpus paludosus (bayonet-grass)	9
Scirpus sp. (bulrush)	2
Carex sp. (sedge)	1
Unidentified Cyperaceæ (sedges)	4
Rumex crispus (curled dock)	1
Rumex sp. (dock)	1
Castalia sp. (waterlily)	1
Unidentified legume (beans and peas)	1
Euphorbiaceæ (spurges)	1
Malvaceæ (mallows)	1
Menyanthes trifoliata (bog bean)	1
Unidentified seeds	8
Vegetable rubbish	1

WILSON PHALAROPE

Steganopus tricolor

The Wilson phalarope (Pl. II), unlike the other two phalaropes, is limited in its range to the Western Hemisphere. The species breeds in the northern part of the United States and southern Canada, from Indiana, Colorado, and eastern California north to central Alberta and Lake Winnipeg. It is more inland in distribution than other species of this family. In the winter season it is found in southern South America in Chile and Argentina, and ranges south to the Falkland Islands. In spring it reaches this country late in April and is on its breeding grounds early in May. The return southward takes place in August, and by September the birds have departed.

For a summer home the Wilson phalarope chooses open grassy marshes surrounding shallow pools and lakelets. The birds may arrive in flocks but soon separate into pairs that form little colonies in the marshes. For a few days all is animation about their chosen homes, as ardent, brilliantly plumaged females pursue coy, plainly colored males on the wing or across the water. Later, when the eggs have been deposited, the birds are more retiring, so that it is possible to traverse the channels leading through the breeding colonies without suspecting that phalaropes are concealed close at hand. On walking out through the shallow water one or two males may be seen to appear and rest on the water near by, or circle restlessly about uttering soft honking calls. For a week or so the females accompany them and share their anxiety, but later these emancipated wives desert their husbands, band together, and drift away to join others

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WILSON PHALAROPE
Steganopus tricolor

of their sex, many of which perhaps have been unmated and have given no attention that season to the reproduction of their kind. Nests are placed in little clumps of grass and are of the simplest construction. Four large eggs, handsomely spotted and colored, are deposited on a slight cushion of broken grass stems. The care and incubation of these falls entirely to the male. Once the eggs are hatched the birds are more retiring than ever. The grasses in the marshes have grown steadily since nesting began, increasing the cover, and the young slip about through this as readily as do rails. It is rare indeed to capture them. Young and adults in winter plumage are nondescript, plain-colored birds, entirely different from the old birds in spring.

Though the Wilson phalaropes often feed while swimming on the surface of the water, they are much more frequently seen walking about on mud bars than other phalaropes. Since the birds appear to range entirely on inland waters, their food shows certain differences from that of the related species. In all, 106 stomachs of this bird were examined, representing the months from May to September. The majority were taken in May, June, and July, and the material for August and September is comparatively slight. The stomachs at hand were collected throughout the range of the bird in the United States, with a small number of specimens from Canada. The animal food represented amounts to 93.3 per cent of the total, and the vegetable, 6.7 per cent. Gravel was present in many stomachs in fair quantity.

ANIMAL FOOD

Crustacea.—In the food of the Wilson phalarope, crustaceans amount to 3.6 per cent, a much smaller quantity than in the two related species. The winter eggs of water fleas (Daphniidæ) were found 7 times, and the brine shrimp (*Artemia fertilis*) 4. Large flocks of phalaropes frequented the lake front on Great Salt Lake, where these tiny shrimps are available in large numbers. Amphipods not identified were found in 7 instances. The majority of the crustaceans were taken in May.

Heteroptera.—Aquatic bugs were favored food, forming 24.4 per cent of the total. Water-boatmen (Corixidæ) were especially sought, being found in 36 stomachs, some of which were crammed with them. Back-swimmers (Notonectidæ) were found 5 times, and shore bugs (*Salda*) 5 times, picked up as they ran about on the mud. Other bug remains not further identified were found in 4 instances. Although heteropterans made nearly one-fourth of the food, the groups represented were very few in number. The number of water-boatmen secured, insects which frequently are found in great abundance in the shallow waters of ponds and marshes, is worthy of attention.

Coleoptera.—Beetles are found in much greater variety than the true bugs, and in number of species replace the crustaceans taken by other phalaropes. They amount to 20.1 per cent. Ground beetles (Carabidæ) were found 13 times; among these a group of small shore-haunting species (*Bembidion*) was represented in 7 instances. Crawling water-beetles (Haliplidæ) were noted 15 times, and predacious diving beetles (Dytiscidæ) 34, in 8 cases being larval individuals. Water-scavenger beetles were also commonly represented, having been taken by 33 birds, in 6 cases in the larval state. The propor-

tion of weevils present among the beetles was very large, as members of this group were identified 27 times. Many were small forms found on aquatic vegetation. Other groups of beetles are represented by scattering individuals picked up at random from the mud or the scanty growths of grass in marshy lowlands. Many of these miscellaneous beetles probably represent individuals which had drifted in on the shore after having been drowned. A few are forms found about decaying bodies, objects encountered frequently on borders of pools where the Wilson phalarope makes its home. Rove beetles (Staphylinidæ) and shining carrion-beetles (Histeridæ) belong especially in this class.

Diptera.—Flies are one of the main sources of food supply for the Wilson phalarope, constituting 43.1 per cent of the total. Mosquito larvæ which alone amounted to 5 per cent of the whole, constituted one-tenth of the food in 27 stomachs collected in May; in 45 taken in June they composed 2.5 per cent. These larvæ were taken also in numbers in birds killed in August. That large numbers of larvæ were often consumed at a single meal was shown by the presence of many of the breathing tubes through which the wrigglers obtain air when at the surface of the water. Crane flies (Tipulidæ) were found 10 times, their larvæ, which are aquatic, 8 times, and adults twice. Gnats (Chironomidæ) were more abundant in the food, being identified in 20 stomachs, the larvæ and pupæ in 10, and adult flies in a like number. In the immature stages insects of this group live in water, but the adults frequently swarm over marshes. To birds secured in the Great Basin region alkali flies (Ephydridæ) were favorite food. In all, members of this family were found 23 times, mostly in the larval or pupal stages, when they are easily accessible. The abundance of these insects in many localities is almost beyond expression in words, and they form a prime source of food in saline situations where few other creatures can exist. Other aquatic fly larvæ that occur in fresh water were taken, among them a large horsefly (*Tabanus*).

Miscellaneous.—Snails were found in two stomachs taken in March, but amounted to only 0.3 per cent of the diet for the whole period. Other miscellaneous animal food came to 1.8 per cent, including a few larvæ of Mayflies and in one case the immature form of a dragonfly. Caddisflies were found once and caterpillar remains once. Ants were found twice, and remains of a few other hymenopterans, but amounted to very little in bulk. Fragments of spiders were found three times. The comparatively small number of miscellaneous forms is surprising considering the manner in which the birds feed.

VEGETABLE FOOD

The vegetable food of the Wilson phalarope composed 6.7 per cent of the total and was made up almost entirely of seeds of aquatic plants or of plants that grow in marshy situations. Material that may be called vegetable rubbish was encountered 5 times and consisted of small particles that probably were obtained incidentally and swallowed by the birds when in eager pursuit of active prey. Seeds of pondweeds were found 6 times and of widgeon grass 5. Species of rushes (*Scirpus*) were identified 19 times, other sedges 6, and seeds of smartweed (*Polygonum*) 5 times. It will be noted at once that most of these seeds have hard outer coverings, and it seems prob-

able that in addition to furnishing some nutriment they also serve as substitutes for bits of gravel, often difficult to get in the silt of lowland marshes but useful in grinding up food.

SUMMARY

In its apparent predilection for mosquito larvæ the Wilson phalarope is perhaps more useful than either of the other two species, as it ranges throughout the summer season on the fresh-water marshes, where mosquitoes often abound. Its destruction of larvæ of horseflies should also be placed to its credit. A large part of the food is composed of other marsh-haunting insects, which, so far as known at present, are of neutral economic significance. From no item can it be charged that this phalarope is injurious, and there could be no excuse for removing it from the protected list. The inroads of agriculture will restrict its breeding grounds, but with the adequate protection now accorded it the bird should maintain its numbers. Fortunately its body is so small that there is no incentive for poachers to kill it as game.

TABLE 2.—*Material identified in the food of the Wilson phalarope as determined from the examination of 106 stomachs, and the number of stomachs in which each item was found*

Animal Matter	
PHYLLOPODA	
Artemia fertilis (brine shrimps)	4
Daphniidæ (water fleas) (winter eggs)	7
AMPHIPODA (shrimplets)	
Unidentified amphipods	7
ODONATA (dragonflies)	
Dragonfly larva	1
EPHEMERIDA (Mayflies)	
Ephemeridæ (larvæ)	2
HETEROPTERA (true bugs)	
Salda sp	5
Notonectidæ (back-swimmers)	5
Corixidæ (water-boatmen)	36
Other heteropterans	4
TRICHOPTERA (caddisflies)	
Unidentified caddisfly larva	1
LEPIDOPTERA (butterflies and moths)	
Caterpillars	1
COLEOPTERA (beetles)	
Bembidion sp	7
Stenolophus limbalis	1
Other Carabidæ (ground beetles)	5
Haliplus ruficollis	1
Haliplus sp	5
Other Haliplidæ (crawling water-beetles)	4
Canthydrus bicolor	1
Coelambus punctatus	1
Coelambus sp	8
Hydroporus morio	2
Dytiscidæ (larvæ)	8
Other Dytiscidæ (predacious diving beetles)	14
Helophorus inquinatus	1
Helophorus sp	8
Berosus striatus	1
Berosus sp	15
Philhydrus sp	1

Animal Matter—Continued	
COLEOPTERA (beetles)—Continued	
Hydrophilidæ (larvæ)	6
Other Hydrophilidæ (water-scavenger beetles)	1
Staphylinidæ (larva)	1
Other Staphylinidæ (rove beetles)	2
Hister sp	1
Cytilus sericeus	1
Heterocerus sp	7
Aphodius sp	1
Monoxia sp	1
Other Chrysomelidæ (leaf beetles)	1
Tenebrionidæ	1
Phytonomus posticus (alfalfa weevil)	1
Onychilis nigrirostris	2
Anchodemus angustus	1
Bagous restrictus	9
Bagous sp	1
Mecopeltus aeneosquamosus	1
Other Curculionidæ (weevils)	5
Sphenophorus sp	2
Unidentified weevils	5
Other coleopterans	11
DIPTERA (flies)	
Tipulidæ (larvæ)	8
Adult Tipulidæ (crane flies)	2
Chironomidæ (larvæ and pupæ)	10
Adult Chironomidæ (midges)	10
Aëdes (Heteronycha) dorsalis (larva)	1
Aëdes (Heteronycha) spencerii (larva)	1
Other Culicidæ (mosquitoes) (larvæ)	6
Stratiomyiidæ (soldier flies) (larvæ)	11
Tabanus sp. (horseflies) (larvæ)	1
Dolichopodidæ (long-footed flies)	3
Syrphidæ (flower flies) (larvæ)	3
Ephydra gracilis (larvæ and pupæ)	3
Ephydra hians (larvæ)	4
Ephydra sp	7
Ephydra sp. (larvæ and pupæ)	8
Other Ephydridæ (alkali flies)	1
Other dipterous larvæ and pupæ	14
Other dipterans	27
HYMENOPTERA (ants, bees, and wasps)	
Unidentified ants	2
Pteromalini	1
Chelonus sp	1
Other hymenopterans	4

TABLE 2.—*Material identified in the food of the Wilson phalarope as determined from the examination of 106 stomachs, and the number of stomachs in which each item was found*—Continued

Animal Matter—Continued	
ARANEIDA (spiders)	
Unidentified spiders	3
MOLLUSCA (snails)	
Physa gyrina	1
Planorbis sp.	1
Vegetable Matter—Seeds	
Potamogeton pectinatus (sago pondweed)	3
Potamogeton sp. (pondweed)	3
Ruppia sp. (widgeon grass)	5
Panicum sp. (switch-grass)	8
Distichlis spicata (salt grass)	2
Scirpus paludosus (bayonet-grass)	12
Scirpus robustus (bulrush)	1
Scirpus sp. (bulrush)	6
Cyperaceæ (sedges)	6
Polygonum sp. (smartweed)	5
Amaranthus sp. (pigweed)	1
Galium sp. (cleavers)	4
Unidentified seeds	4
Vegetable rubbish	5

AVOCET

Recurvirostra americana

The large, strikingly marked avocet is found in greatest abundance west of the Mississippi River, where it ranges from southern Canada south to the Mexican border. In winter avocets pass south through Mexico as far as Guatemala, some remaining in southern California and on the Gulf coast of Texas. Formerly they were found regularly along the Atlantic coast, but now are known only as stragglers in that region. Avocets are most common at present perhaps in the northern part of the Plains region and the Great Basin. Wherever found they attract attention, even from those ordinarily unobservant of birds. Though the long, slender legs and long neck may seem ungainly, avocets are graceful whether in movement or at rest. The bill, which is broad at the base, is flattened and thin, and at the tip is curved upward. The toes are webbed. The long pointed wings are black in contrast to the white of the remainder of the plumage, which in the breeding season is varied by a cinnamon wash on the head and neck.

Though found at times alone, avocets are habitually gregarious, like many other shorebirds. During the breeding season they gather in colonies and nest on low ground adjacent to ponds, bays, or slow-running channels. Four strongly marked eggs are deposited in a slight hollow scantily lined with a few bits of grass or weed stems. The sites chosen often are subject to inundation by sudden floods, when the birds scurry about, seemingly in confusion, but in reality working actively to build up the nest in order to support the eggs above the level of the encroaching water. In some cases it may be necessary to erect a structure 12 or 15 inches in height. Weeds, small sticks, bones, or dried bodies of ducks or other birds, feathers, or any other materials available are utilized as building materials.

Young avocets are able to run about at birth and accompany their parents across the open flats in search of food. A visit to a nesting colony is of the greatest interest to one who enjoys observing birds. Male avocets come flying out with loud calls to meet the intruder, and when he is actually near the nests or young the uproar becomes almost deafening. The adults dart at the head of the supposed enemy, or limp or flutter about, posturing grotesquely. Young birds are hustled away by parents, with the aid of solicitous neighbors, to be concealed in the scanty herbage, or piloted far out on the open flats, where they may be safe from capture.

After the breeding season, avocets are more quiet and sedate and pay little attention to those who may visit their haunts, except to walk up and inspect them with mild curiosity. Flocks of the birds search for food scattered about in shallow water, and do not hesitate to swim when necessary in crossing the deeper channels. Frequently a dozen or more feed in company, walking slowly along, shoulder to shoulder, as though in drill formation, at each forward step thrusting the head under water and sweeping the recurved bill along the bottom with a scythe-like swing that must arouse consternation among water-boatmen and other aquatic denizens of the bays and ponds. At times the writer has observed as many as 300 of these handsome birds feeding thus in a single company, a scene at once spirited and striking. The hunter who through idle curiosity chances to kill one of these beautiful birds near his blind may well repent his wantonness, as other avocets with low calls gather about and examine the body of their former comrade with the greatest solicitude.

The avocet stomachs studied in the present work come in the main from California, Utah, Saskatchewan, and North Dakota. In all 67 stomachs were examined, taken during a continuous period of eight months from March to October. Animal food in these amounted to 65.1 per cent and vegetable to 34.9 per cent.

When feeding, avocets prefer shallow bays or ponds with muddy bottoms where the water varies from half an inch to 4 inches or more in depth. Some have supposed that the extreme thinness of the bill was caused by abrasion on sandy bottoms, a theory without basis, as the form of the bill conforms to the shape of the bones of the mandibles and no wear is apparent. As the birds feed much of the time by immersing the head, anything that may touch the bill is gathered indiscriminately, as in feeding they depend upon the sense of touch. From their manner of feeding, avocets are often scavengers, taking living or recently dead prey without much choice. The large tapeworms found almost without fail in the duodenum of the avocet are transmitted from one bird to another in this manner. The cast-off terminal segments of the worms (bearing the eggs) are picked up and swallowed by other avocets, a proceeding which the writer has personally observed. Avocets also pick up matter floating in the water, on or near the surface, or take insects and seeds from mud bars. The insects may be those living in such localities or may be individuals that have been washed up in drift.

ANIMAL FOOD

Crustacea.—Though represented only by remains of a flattened phyllopod known as *Apus*, crustaceans amount to 8.6 per cent of the total food. These strange animals inhabit shallow ponds but are so local in distribution that they may be found only occasionally in long distances, so that they are hardly a common article of bird food. Large numbers had been eaten by the three avocets in which such remains were found.

Odonata.—Dragonfly nymphs were found in three avocets killed in May and June, but amounted only to 0.1 per cent of the total food.

Hemiptera.—True bugs were more staple diet, and were common in occurrence, though forming only 5.9 per cent of the bulk of the food. They were identified in 26 of the birds examined. Back-swimmers

(*Notonecta*) were found 3 times and a form of water bug (Belostomatidæ) once. Water-boatmen, identified in 23 instances, seem to be standard article of diet.

Coleoptera.—Beetles as a group constitute 11.4 per cent of the food. Among them small shore-haunting ground beetles were common, none known to be of economic importance. A few crawling water-beetles (Haliplidæ) were found and a number of predacious diving beetles. Larvæ of this latter group were identified 9 times. Water-scavenger beetles in both adult and larval stages also were well represented. Weevils were as abundant as other groups of beetles and included billbugs (*Sphenophorus*) in 5 instances.

Diptera.—Flies, amounting to 23.8 per cent of the total subsistence, compose the largest single item in the animal food. Although abundantly represented, the species taken belong to comparatively few groups. Larvæ of crane flies (Tipulidæ) were taken 4 times and larvæ and pupæ of flies that could not be certainly identified 5 times. The immature stages of gnats (Chironomidæ) were especially sought. Individuals identified as belonging to the typical genus *Chironomus* were found 6 times, and those of related forms, 11. Often many were found in one stomach, though ordinarily so broken that they could not be counted with accuracy. In a number of instances, however, it was ascertained that several hundred had been swallowed by one bird.

In the Great Basin region alkali flies (Ephydridæ) were favored as food, as they were not only palatable but abundant about brackish or saline waters and in most cases easily secured. In spring and early summer thousands of these flies are found gathered in close array on expanses of soft, alkaline mud. Avocets run up hastily to such congregations and strike at them with lateral sweeping motions that fill their bills with them and with soft mud before the insects can escape. At such attacks the flies in limited areas rise in sudden swarms, but others at a short distance remain quiet, so that by taking a few steps the birds are able to make another attack on gatherings whose numbers have been augmented by the arrival of individuals frightened up at the first onslaught. The larvæ of these flies abound in many places, especially in the strongly saline waters of the lakes characteristic of the Great Basin. At Great Salt Lake many avocets after the nesting season frequent shallow bays near the lake front, where these larvæ swarm, in order to feed upon them.

Miscellaneous.—Snails are eaten occasionally by avocets and were found in 6 stomachs, although they amount only to 0.8 per cent of the total. The species are those common in shallow ponds and marshes. Other miscellaneous items of animal food, 14.5 per cent, include a varied assemblage of forms, none of which were present in sufficient number to merit separate tabulation. Nymphs of May-flies were found twice, and cases and other remains of caddisfly larvæ 3 times. Caterpillars were identified 3 times, and fragments of small grasshoppers (Acridiidæ), 4. The Hymenoptera were represented by single findings of ants, a larrid, a braconid, and one other form not identified. Spiders were found in 2 instances. A small chub (*Leuciscus lineatus*) had been eaten by one bird and an unidentified fish by another. Bones of a tiny salamander were encountered in the stomach of one bird.

VEGETABLE FOOD

Vegetable matter was a regular constituent in the diet of the avocet, being found in 56 of the 67 stomachs examined, and totaling 34.9 per cent for the entire period. A considerable part of this is composed of seeds of marsh or aquatic plants. Thus seeds of the sago pondweed (*Potamogeton pectinatus*) were found 17 times and those of some related form once. Salt grass (*Distichlis spicata*) was taken 3 times, bayonet-grass (*Scirpus paludosus*) 7, and related bulrushes of the same genus as the latter, also were found 7 times. The names of a few scattered seeds from other groups are given in Table 3.

Vegetable matter other than seeds also was eaten. Thus leaves and stems of the sago pondweed were abundantly represented and were identified in 17 stomachs. Miscellaneous bits of vegetation classed as vegetable rubbish were found 19 times. This matter in part was evidently picked up at random in feeding in shallow water. Some of this must be classed as waste, but as it is possible to extract nutriment from a portion it must be considered of some value. It is ground up in digestion by means of the gravel and hard seeds swallowed for the purpose.

SUMMARY

Analysis of the food of the avocet shows that this species has no injurious tendencies whatever. Much of the animal food belongs to forms that are economically neutral. The weevils eaten are to be placed on the credit side of the account, as they are nearly always harmful or may become so if given opportunity.

In some regions the "snipe," as the avocet is sometimes known, is considered a game bird or is hunted for food. Shooting avocets has no element of sport, however, as it is easy to walk up within gun range of them, and they are fearless and frequently come around to examine the hunter. Though the birds are of fair size, the flesh is not savory and offers no excuse for killing them. They rightfully have been removed from the category of game birds and are now accorded full protection under the regulations of the Federal migratory-bird treaty act. This is fortunate indeed for their continuance, as they are large and conspicuous and easily killed. They rear but one brood of four young each season and are subject normally to many dangers, so that with shooting the species would soon be exterminated. With increase in cultivation of lands throughout their range their haunts have been much restricted. The birds remaining have in many instances been brought into closer relation with man, so that the good they do is more apparent.

TABLE 3.—*Material identified in the food of the avocet as determined from the examination of 67 stomachs, and the number of stomachs in which each item was found*

Animal Matter		Animal Matter—Continued	
PHYLLOPODA		ORTHOPTERA (grasshoppers, etc.)	
Apus sp	3	Acrididæ	4
ODONATA (dragonflies)		HETEROPTERA (true bugs)	
Dragonfly nymphs	3	Notonecta sp. (back-swimmers)	3
		Belostomatidæ (giant water bugs)	1
EPHEMERIDA (Mayflies)		Arctocorixa dispersa (water-boatman)	1
		Other Corixidæ (water-boatmen)	22
Ephemeridæ (nymphs)	2	Other heteropterans	1

TABLE 3.—*Material identified in the food of the avocet as determined from the examination of 67 stomachs, and the number of stomachs in which each item was found*—Continued

Animal Matter—Continued	
TRICHOPTERA (caddisflies)	
Caddisfly larvæ	3
LEPIDOPTERA (butterflies and moths)	
Caterpillars	3
COLEOPTERA (beetles)	
Bembidion insulatum	1
Bembidion scudderi	1
Bembidion sp	1
Pterostichus sp	2
Selenophorus sp	1
Peltodytes callosus	1
Other Haliplidæ (crawling water-beetles)	2
Coelambus sp	2
Hydroporus sp	2
Dytiscidæ (larvæ)	9
Other Dytiscidæ (predacious diving beetles)	1
Helophorus sp	4
Tropisternus sp	2
Berosus sp	5
Berosus sp. (larvæ)	1
Hydrophilidæ (water-scavenger beetles) (larvæ)	5
Heterocerus sp	2
Tenebrionidæ	1
Phytonomous sp	1
Hyperodes sp	1
Other Curculionidæ (weevils)	2
Sphenophorus ochreus (billbug)	1
Sphenophorus mormon (billbug)	1
Sphenophorus sp. (billbug)	3
Other coleopterans (including larvæ)	10
DIPTERA (flies)	
Tipulidæ (crane flies) (larvæ)	4
Chironomus sp. (larvæ)	6
Other Chironomidæ (gnats) (larvæ)	11
Ephydra gracilis (alkali flies) (adults and larvæ)	2
Ephydra hians (larvæ)	2
Ephydra sp	8
Other dipteran larvæ and pupæ	5

Animal Matter—Continued	
HYMENOPTERA (ants, bees, and wasps)	
Larridæ	1
Ant	1
Braconidæ	1
Other hymenopterans	1
ARANEIDA (spiders)	
Spiders	2
MOLLUSCA (snails and mussels)	
Physa gyrina	2
Planorbis trivolvis	3
Planorbis sp	1
Other mollusks (eggs)	1
PISCES (fishes)	
Leuciscus lineatus	1
Other fishes	1
AMPHIBIA (frogs, toads, and salamanders)	
Salamander	1
Vegetable Matter—Seeds	
Marsilea vestita (pepperwort)	1
Marsilea sp. (pepperwort)	3
Juniperus utahensis (juniper)	1
Potamogeton pectinatus (sago pondweed) (seeds)	17
Potamogeton pectinatus (leaves and stems)	17
Potamogeton sp. (pondweed)	1
Ruppia occidentalis (widgeon grass)	1
Distichilis spicata (salt grass)	3
Scirpus paludosus (bayonet-grass)	7
Scirpus sp. (bulrush)	7
Other Cyperaceæ (sedges)	1
Polygonum sp. (smartweed)	4
Atriplex sp. (saltbush)	1
Other Chenopodiaceæ	1
Legume	1
Composite	1
Other seeds	1
Vegetable rubbish	19

BLACK-NECKED STILT

Himantopus mexicanus

The black-necked stilt (Pl. III) is one of the comparatively few species of shorebirds that have a center of distribution within the Tropics and extend from there northward to within our limits. In the western United States the stilt ranges north to southern Oregon, northern Utah, and Colorado; in the East it is found at present in Florida, Louisiana, and Texas, though formerly it nested as far north as Delaware Bay or possibly even more northern latitudes.

In the West during the breeding season stilts are found in company with avocets about shallow pools and lakes or on the muddy banks of channels running through lowland marshes. Though usually less common than their larger neighbors, they add to the uproar and excitement when the breeding colonies are invaded. Stilts are not so demonstrative as avocets and remain more in the background, where the steady repetition of their sharp notes furnishes a yelping accompaniment to the more vociferous outbursts of the others. When greatly excited, stilts spring in the air and circle about or, with steadily beating wings, remain stationary a few feet from the

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BLACK-NECKED STILT
Himantopus mexicanus

ground, their long, red legs hanging straight down. The dead black of the upperparts with its greenish sheen and the pure white of the breast form a pleasing contrast of color, which, with the greatly elongated legs, serves to distinguish the stilt from any other of our shorebirds.

The nests and eggs of stilts are very similar to those of the avocet, and the young when first hatched closely resemble young avocets, but may be distinguished by the lack of a hind toe. The young grow rapidly, and the increase in the length of their legs is amazing. Until the bones are well formed the young, when not feeding, prefer to rest with the full length of the tarsus extended on the ground, but even then appear as tall as other shorebirds of similar body size.

Stilts show considerable attachment for their young, and, unless dispersed by some untoward accident, frequently remain in family groups long after the young are able to care for themselves. As the latter become strong on the wing the family parties range over the country in search of suitable feeding grounds. As the nights grow cold in the North the birds band together in larger flocks and finally, on some moonlit night in September, young and old may be heard calling as they pass overhead on their southward migration.

Stilts feed by picking up insects on muddy shores or in shallow water, and though not averse to frequenting alkaline areas, on the whole prefer fresher water than do avocets. For detailed analysis, 80 stomachs of the black-necked stilt were available, distributed from March to August, and collected in California, Utah, Florida, and Porto Rico. Vegetable food in these amounted to only 1.1 per cent, whereas the animal matter formed 98.9 per cent. The birds are adept in seizing rapidly-moving prey and in general are very methodical in their manner of obtaining food. Gravel is picked up to some extent to aid digestion, and part of the seeds taken may have been swallowed for the same purpose.

ANIMAL FOOD

The animal food of the black-necked stilt shows more diversity than in the case of preceding species, though some of the items taken are present in comparatively small quantity.

Crustacea.—Crustaceans constitute 0.5 per cent of the total food and were identified in stomachs collected in March and April. In eight remains of crawfishes were found, an important item, as these animals are highly destructive to crops in some localities.

Odonata.—Nymphs of dragonflies make up 2.9 per cent and were eaten by nine birds, mainly in April and July.

Trichoptera.—Cases of caddisflies with their occupants were found abundantly in stomachs taken in March and April and amount to 3.3 per cent of the entire food. In many instances the cases had been attached to submerged vegetation, part of which had come away when the container was torn loose and had been swallowed with the larvæ.

Agnatha.—Mayfly nymphs, a number of which were taken during April, were identified in five stomachs (1.3 per cent).

Heteroptera.—Aquatic bugs with a few others were eaten in large quantities and amount to 35 per cent, the largest single item in the food of the stilt. They were found regularly in all months for which material was available. Water-boatmen (Corixidæ), encountered

27 times, were most abundantly represented. Remains of many were found in several of the stomachs opened, and small fragments were often present in stomachs filled with other insects. Water striders (*Gerris*) were found three times, true water bugs of small size (*Belostoma*) six times, and back-swimmers (Notonectidæ) twice. A shore bug (*Salda*) was identified once. Shore bugs are often abundant on mud bars where stilts delight to feed, but apparently are usually overlooked or disregarded.

Coleoptera.—Beetles, practically as important in the food as the bugs, composed 32.4 per cent, but were present in much greater variety. A tiger beetle (*Cicindela*), found in one instance, is the only species taken that may be considered beneficial. Small flat beetles of the genus *Bembidion*, of which a variety of species inhabit muddy shores, were found twice and other ground beetles (Carabidæ) seven times. Crawling water-beetles (Haliplidæ) were identified in 18 instances, among them representatives of various species. Predacious diving beetles were identified 26 times and their larvæ 9 times. The species of this group taken by the stilt were those of small size, as the bird is unable to swallow the larger forms. The same fact was observed in the water-scavenger beetles identified in 58 stomachs. The genus *Berosus*, the species of which are frequently abundant in shallow water, was found 21 times and the genus *Tropisternus*, 28. Larvæ of water-scavenger beetles were identified in 22 instances, so that on the whole this group of beetles was abundantly represented.

An abundance of weevils is noted as one of the prominent items among the beetles. Curculionidæ alone were represented in 44 stomachs and billbugs (*Sphenophorus*) in 6. The curculios eaten were mainly individuals of the genera *Bagous* and *Onychilis*, which occur on aquatic vegetation. Weevils are mostly injurious, and attention may be drawn to the evident predilection for these beetles shown by the stilt.

Diptera.—Flies amount to 9.7 per cent of the total food. The majority were still in the immature stages, though occasionally adult flies were eaten. These remains were most abundant in material from the Great Basin region, where certain groups of dipterans abound. The young of small crane flies (Limnobiinæ) were found 3 times and of gnats (Chironomidæ) 4 times. The larval forms of mosquitoes were identified twice, evidence of good that may be accomplished in the destruction of these pests. Alkali flies (Ephydridæ), and soldier flies (Stratiomyiidae), represented by several forms, were encountered 9 times each. The species of flies taken, so far as it was possible to identify them, are without exception those having larval forms of aquatic habit.

Mollusca.—Represented by several common species of marsh or pond inhabiting snails, mollusks make up 7.9 per cent of the food, and were identified 35 times in all, most abundantly in material collected in Florida. In 37 birds taken in April (all but 2 from Florida) snails amounted to 15.4 per cent of the food.

Pisces.—Small fishes were identified in 7 instances, but amount to only 3.2 per cent of the total food. A carp was found once and tiny sunfishes twice, but remains of others were not identified. The fishes eaten were of the smallest size and have little economic significance.

Miscellaneous.—Other animal food, amounting to 2.7 per cent, included remains of grasshoppers in 3 instances, and crickets, caterpillars, and a tiny frog in 1 each. The grasshoppers and crickets may be mentioned as of distinct economic importance and as a further indication of the value of the stilt as an insect destroyer.

VEGETABLE FOOD

The vegetable food of the black-necked stilt, composing 1.1 per cent of the total, has little significance in determining the economic status of the bird. It consisted in the main of a few seeds of aquatic or marsh plants, with fragments of vegetable débris in a few instances, taken as rubbish adhering to other food. The flattened sporocarps of *Marsilea* were found in 1 stomach and seeds of the sago pondweed (*Potamogeton pectinatus*) in 4. Seeds of several species of bulrush were encountered in 7 instances and leaves and stems of the sago pondweed in 2. The latter is an item in favor with many water birds and may be considered nutritious and readily digestible. As most of the seeds eaten were hard and firmly surfaced, it is probable that like gravel they perform an important function in preparing softer food for digestion, in addition to serving as nutriment themselves.

SUMMARY

From the foregoing details it seems that the black-necked stilt is of somewhat greater importance from an economic viewpoint than the avocet. The fact that it eats crawfishes, though in small quantity, is one point in its favor. Among the insects taken, a great majority are of no particular importance, but attention must be called to an evident predilection of stilts for billbugs (*Sphenophorus*). The only valuable beetle eaten was a single tiger beetle, of which fragments were found in one stomach, an item of small weight compared with the destructive beetles consumed. Mosquito larvæ were found in two instances, an indication of a valuable feeding habit which in suitable localities may render these birds of importance. The true bugs eaten are of neutral significance, save in the case of the waterbugs (*Belostoma*), which, being predatory on small fry of fishes, must be considered injurious, and they form a part of the food to the credit of the bird. Flies and mollusks are taken in abundance, but except for the mosquito larvæ mentioned, are of neutral significance. The small fishes eaten are tiny individuals of species having no particular value.

Economically the stilt has a decided balance in its favor. It apparently has never been considered a game bird, as it is small in body and poor in flesh. The tameness and lack of sophistication of the birds have often led to their destruction by careless gunners, so that they have greatly decreased in numbers or have even disappeared from more thickly settled regions. As they are conspicuous in form, and fearless and noisy during the breeding season, they attract attention which often is disastrous. They should be protected and encouraged generally and under such conditions should maintain or even increase their present numbers. Those who chance to come intimately in contact with stilts will find that they are not only beneficial in their food habits but that they merit observation for their many interesting ways.

TABLE 4.—*Material identified in the food of the black-necked stilt as determined from the examination of 80 stomachs, and the number of stomachs in which each item was found*

Animal Matter	
CRUSTACEA (crabs, shrimps, etc.)	
Cambarus sp. (crawfishes)	8
Other crustaceans	1
ODONATA (dragonflies)	
Dragonfly nymphs	9
EPHEMERIDA (Mayflies)	
Ephemeridæ (nymphs)	5
ORTHOPTERA (grasshoppers, etc.)	
Acridiidæ (short-horned grasshoppers)	3
Gryllidæ (crickets)	1
HETEROPTERA (true bugs)	
Pentatomidæ (stink-bugs)	1
Miridæ (plant bugs)	1
Gerris sp. (water-striders)	3
Salda sp. (shorebugs)	1
Notonecta undulata (back-swimmers)	1
Other Notonectidæ (back-swimmers)	1
Belostoma flumineum (giant water-bug)	1
Belostoma sp. (giant water-bug)	5
Arctocorixa interrupta (water-boatman)	1
Other Corixidæ (water-boatmen)	26
Other heteropterans	1
TRICHOPTERA (caddisflies)	
Caddisfly larvæ	19
LEPIDOPTERA (butterflies and moths)	
Caterpillars	1
COLEOPTERA (beetles)	
Cicindela sp. (tiger beetle)	1
Bembidion insulatum	1
Bembidion sp	1
Other Carabidæ (ground beetles)	7
Haliplus concolor	2
Haliplus sp	8
Peltodytes callosus	4
Peltodytes muticus	3
Other Haliplidæ (crawling water-beetles)	1
Coelambus pedalis	1
Coelambus sp	11
Deronectes striatellus	1
Coptotomus obscurus	1
Thermonectes ornaticollis	1
Dytiscidæ (larvæ)	9
Other Dytiscidæ (predacious diving beetles)	1
Helophorus sp	3
Berosus pugnax	2
Berosus infuscatus	2
Berosus sp	17
Tropisternus limbalis	6
Tropisternus nimbatus	6
Tropisternus californicus	1
Tropisternus sp	15
Cercyon sp	1
Hydrophilidæ (larvæ)	22
Other Hydrophilidæ (water-scavenger beetles)	5

Animal Matter—Continued	
COLEOPTERA (beetles)—Continued	
Heterocerus sp	1
Heterocerus sp. (larvæ)	1
Hyperodes sp	1
Onychilis nigrirostris	2
Bagous mammillatus	1
Bagous obliquus	14
Bagous restrictus	13
Other Curculionidæ (weevils)	11
Sphenophorus ochreus (billbugs)	1
Sphenophorus pertinax (billbugs)	2
Sphenophorus sp. (billbugs)	3
DIPTERA (flies)	
Limnobiinæ (crane flies) (larvæ)	3
Chironomidæ	1
Chironomidæ (midges) (larvæ)	4
Culicidæ (mosquitoes) (larvæ and pupæ)	2
Stratiomyia sp. (larvæ)	1
Odontomyia sp. (larvæ)	7
Other Stratiomyiidæ (soldier flies, larvæ)	1
Syrphidæ (flower flies) (larvæ)	1
Ephydra gracilis (alkali flies)	5
Ephydra subopaca (alkali flies) (larvæ)	1
Ephydra sp. (alkali flies) (larvæ)	3
Other dipterous larvæ	5
Other dipterans	1
ARANEIDA spiders)	
Spiders	3
PELECYPODA (mussels)	
Small bivalves	2
GASTROPODA (snails)	
Bittium varium	1
Amnicola sp	9
Vivipara georgiana	3
Physa gyrina	2
Physa sp	1
Planorbis trivolvis	3
Planorbis sp	1
Other snails	12
PISCES (fishes)	
Cyprinus carpio (carp)	1
Centrarchidæ (sunfishes)	2
Other fishes	4
AMPHIBIA (frogs, toads, etc.)	
Frog	1
Vegetable Matter	
Marsilea sp (pepperwort)	1
Potamogeton pectinatus (sago pondweed) (seeds)	4
Potamogeton pectinatus (leaves)	2
Potamogeton sp. (pondweed)	1
Scirpus americanus (three-square)	2
Scirpus paludosus (bayonet-grass)	4
Scirpus sp. (bulrush)	1
Cephalanthus occidentalis (buttonbush)	1
Vegetable rubbish	6

TABLE 5.—*Percentages of principal groups of items in the food of the five shorebirds discussed*

Bird	Number of stomachs	Crustacea	Odonata, Trichoptera, Ephemerida	Hemiptera	Coleoptera	Diptera	Mollusca	Pisces	Miscellaneous	Total animal food	Vegetable food
Red phalarope	36	33.5	------	------	27.3	22.7	------	6.8	9.7	100.0	Tr.
Northern phalarope	155	9.3	.2	31.8	16.5	32.8	2.7	------	3.9	97.2	2.8
Wilson phalarope	106	3.6	------	24.4	20.1	43.1	.3	------	1.8	93.3	6.7
Avocet	67	8.6	.1	5.9	11.4	23.8	.8	------	14.5	65.1	34.9
Black-necked stilt	80	.5	7.5	35	32.4	9.7	7.9	3.2	2.7	98.9	1.1

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